Exhibit M

Exhibit E-10

INVALIDITY CONTENTIONS FOR U.S. PATENT NO. 7,177,369
BASED ON PROJECT ANGEL ("PROJECT ANGEL")

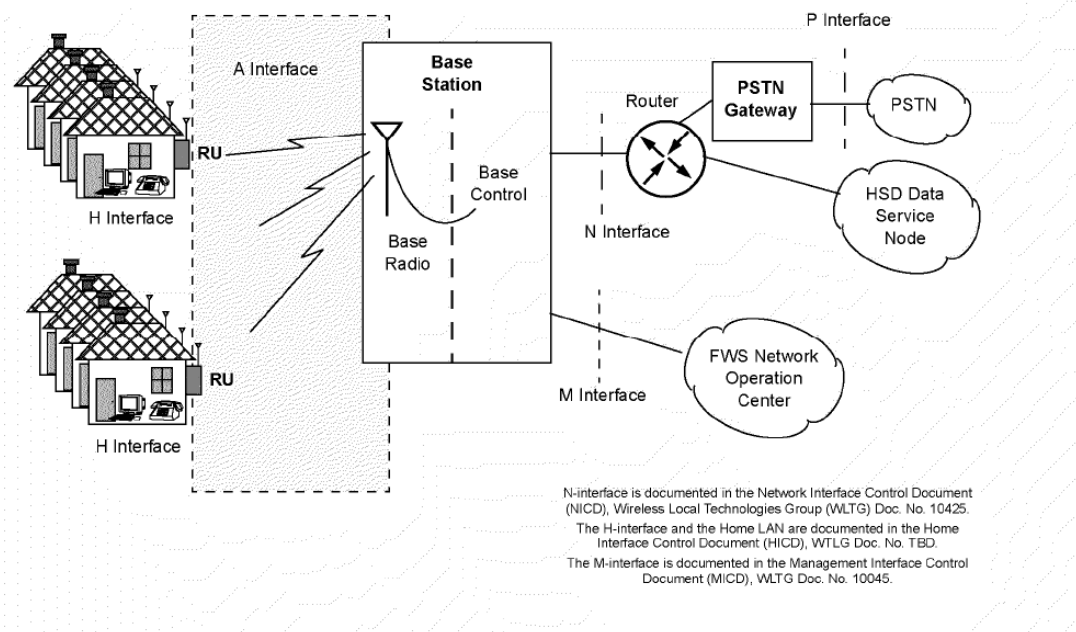
Based upon Plaintiff's Complaint, Infringement Contentions, and apparent claim constructions and application of the claims to Defendant's accused products, as best as they can be deciphered, the reference charted below anticipates or at least renders obvious the asserted claims. These invalidity contentions are not an admission by the Defendant that the accused products are covered by or infringe the asserted claims, particularly when these claims are properly construed and applied. These invalidity contentions are not an admission that the Defendant concedes or acquiesces to any claim construction implied or suggested by Plaintiff's Complaint or Infringement Contentions. Nor is Defendant asserting any claim construction positions through these charts, including whether the preamble is a limitation. The portions of the prior art reference cited below are not exhaustive but are exemplary in nature.

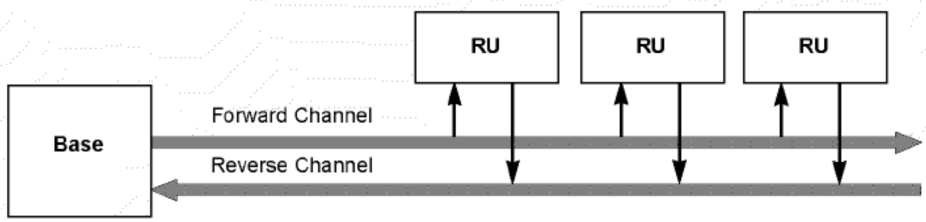
As noted in the Invalidity Cover Pleading and other invalidity charts for other asserted patents, Project Angel was developed by AT&T and was publicly known, used, and available prior to the priority date of the '369 patent. This product and its associated documentation is prior art under at least 35 U.S.C. § 102(a)(b), and 103(a). As described in the following claim chart, the asserted claims of U.S. Patent No. 7,177,369 (the "'369 Patent"), are invalid as anticipated by Project Angel.

To the extent that Project Angel is found not to anticipate one or more of the asserted claims of the '369 Patent, these claims are invalid as obvious in view of Project Angel alone or in combination with other prior art references disclosed in Defendant's Invalidity Contentions and accompanying charts, including without limitation as set forth below.

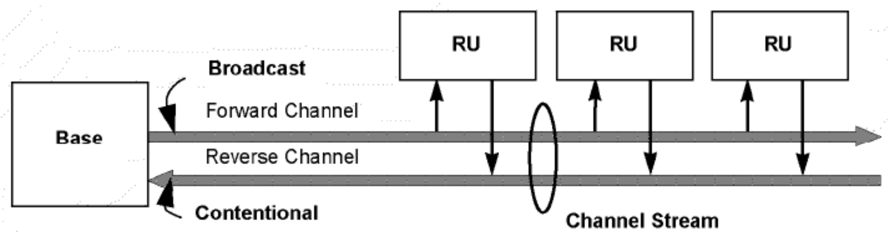
The charts below are based on at least the following documents.

Beginning Bates Number	Title	Referenced Herein as
DEFS-PA_00000881	"Chapter 2 Physical Layer"	Angel1
DEFS-PA_00000599	"Airlink 2.0 Interface Control Document"	Angel2

’369 Patent	Project Angel
Claim 1	
1[p] A method comprising:	To the extent the preamble is limiting, Project Angel discloses this claim limitation explicitly, inherently, or as a matter of common sense, or it would have been obvious to add missing aspects of the limitation. For example, see the following passages and/or figures, as well as all related disclosures: Angel 1 at section 2.1. Angel2 at Figure 1.1 *Figure 1.1 Fixed Wireless System Architecture* 

'369 Patent	Project Angel
	Angel2 at section 1.2 The channel stream includes a forward channel from the Base Station to RU(s), and a reverse channel from RUs to the Base Station. *Figure 1.4 Model of Operation*  **Voice Service** Voice calls in a cell use available voice channels between RUs and the Base. Once voice channels are allocated for a call, those channels are dedicated to the voice call during the call period. **Data Service** The data forward channel is a contentionless broadcast channel carrying block transmissions from the Base Station. RU address information is received and decoded by all RUs on the channel simultaneously. If more than one RU is addressed then all addressed RUs receive and decode the channel data simultaneously. The data reverse channel is shared among all RUs; access arbitration and contention resolution is controlled by the Base Station using a Collision Free Multiple Access (CFMA) scheme. RUs arbitrate with the Base Station for the reverse channel using an orthogonal request mechanism. After the RU arbitration period, the Base Station grants access to the requesting RUs in a controlled manner. Angel2 at section 1.3

’369 Patent	Project Angel
	1.3 Physical Layer The Physical layer is the foundation of airlink communication over which all voice, data, and information/control signals are actually transmitted. The Physical layer is based on an Orthogonal Frequency Division Multiplexed (OFDM) waveform comprised of multiple frequency domain channels. Each frequency channel is further subdivided into Time Division Multiple Access (TDMA) time slots. A TDMA time slot on a frequency domain channel is referred to as a physical channel. Logical channels are formed using physical channels, either separately or aggregated for high bit rates. Voice and HSD share the same physical airlink. The Physical layer of the OSI architecture provides the following services: • Transmission and reception of voice and data traffic • Transmission and reception of control information over the logical control channels between the RU and the Base • Error detection and Forward Error Correction (FEC) for messages corrupted during the transmission or reception process • RU frame and symbol-level synchronization to global time references transmitted by the serving Base Station • Power control to minimize cochannel interference Angel2 at section 1.3.2 HSD Channel Characterstics.

'369 Patent	Project Angel
	The physical channels assigned to an RU constitute a "channel stream" that provides full duplex data communications capability between a Base and RU. The physical channels assigned to carry Base-to-RU traffic constitute the "forward channel" and those carrying RU-to-Base traffic constitute the "reverse channel." Forward channel and reverse channel capacities may differ. These relationships are illustrated in Figure 1.6. *Figure 1.6 Data Physical Channel Relationships*  Angel2 at section 1.5

'369 Patent	Project Angel
	HSD Medium Access Control (DMAC) The DMAC layer provides orderly and efficient use of the airlink Physical layer for the HTL. The DMAC layer provides • Medium access control • Channel status insertion • Error correction encoding • Frame recognition, and error detection/recovery services **HSD Transport Layer (HTL)** The transport layer provides reliable, session-oriented, error-free data airlink connections. In the upper layer interface, HTL multiplexes packets from applications into a single data link connection, and demultiplexes them in the reverse direction. In the lower layer interface, HTL uses the service provided by the device driver to deliver/receive packets to/from the airlink. HTL provides • Provisioning and support of multiple RUs sharing access to a single physical medium • Error detection and recovery • Flow control • Sequence control • Multiple Types Of Service (TOS) • Segmentation, assembly, and reassembly (SAR) • Encryption and decryption Angel2 at 2.1 (use of OFDM). Angel2 at 2.2.1:

’369 Patent	Project Angel
	2.2.1 Services Provided by the Physical Layer The Physical layer provides the following services to Voice and Data MAC layers as well as the VTch interface: • Transmission and reception of voice and data traffic • Transmission and reception of control information • Forward Error Control (FEC) and detection of messages corrupted during the transmission or reception process • RU frame and bit-level synchronization to global time references transmitted by the serving Base Station • Power control to minimize co-channel interference • Dynamic channel allocation for voice services • Collection of Physical layer performance metrics at both the Base and RU to support channel allocation, network optimization, and performance validation Angel2 at 2.4 “OFDM Resources” (entire section explaining usage of OFDM) Angel2 at ssection 2.5 “Logical Channel Description” (explaining usage of different subbands and of QPSK as recited in the dependent claims.

<table>
<tr><th>’369 Patent</th><th>Project Angel</th></tr>
<tr><td></td><td>

2.5 Logical Channel Descriptions

2.5.1 Channel Resource Mapping

Channel resources can be dynamically allocated to accommodate different voice and data needs for individual circumstances. Figure 2.5.16 and Figure 2.5.17 show the channel resource mapping for the data, voice and network access logical channels. Over each 1 MHz subband, N time slots are provisioned for high speed data service (slots ts_0-ts_{N-1}) and remaining (i.e., 20-N) time slots are provisioned for voice service (slots ts_N-ts_{19}), where N=10, 12,..., 18. That is, the number of time slots provisioned for data service can be increased from ten to a maximum of 18 at multiples of two, whereas the number of time slots provisioned for voice service can be reduced from ten to two. Network access channels occupy a portion of data time slots. The synchronization channel is comprised of 18 singular tones in the voice slots and two tones in the data slots. The logical channels, along with the synchronization channel are described in detail in the following sections. With this channel resource mapping, the HSD downlink raw data rate per sector is given in Table 2.5.7.

Table 2.5.7 HSD capacity per sector.

	64 QAM	16 QAM	QPSK
Maximum (N=18)	3.3 Mbps	2.2 Mbps	1.1 Mbps
Minimum (N=10)	1.98 Mbps	1.32 Mbps	0.66 Mbps

See section 2.6 on Space-Frequency Block Coding

See section 2.7 on Coding:

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<tr><th>’369 Patent</th><th>Project Angel</th></tr>
<tr><td></td><td>
<h2>2.7 Coding and Modulation</h2>
The Physical layer uses coding and modulation for consistent transmission structures for FWS voice, data, and control channels. The transmission structures described in this section are for the steady-state period of a voice connection or a data burst.
The transmission formats in this section are for the following channels:

Voice channel in 16-QAM mode
Voice channel in 64-QAM mode
Voice channel in QPSK mode
Data channel in 16 QAM mode
Data channel in 64 QAM mode
Data channel in QPSK mode
NAC
HCC

All descriptions are for steady state operation.
Angel2 at section 2.7.2.4 on QPSK voice.
Angel2 at Section 2.9:
</td></tr>
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’369 Patent	Project Angel
	2.9 Radio-Frequency Signal Propagation Environment The FWS airlink is designed to support wireless local loop service. The OFDM waveform transmitted over the 1 MHz channel will undergo amplitude and phase distortions that are time-varying and frequency-selective in nature. Channel variations in time and frequency may be quantified by coherence time and bandwidth of the channel, respectively. Simulations based on propagation measurements for the wireless local loop service have shown the following: • **Coherence Time:** For 90% correlation, the coherence time is 15 ms, while for 50% correlation, the coherence time is 77 ms. Based on these numbers and the duration of TDMA slot (375 μsec), the channel can be considered to be a slowly fading channel; therefore, for each burst, the propagation channel can be modeled as a constant complex coefficient that does not vary with time. • **Coherence Bandwidth:** For 90% correlation, the coherence bandwidth is 265 kHz, while for 50% correlation, the coherence bandwidth is 875 kHz. Based on these numbers, the channel can be assumed to be flat for a frequency-time resource (FTR) with the bandwidth of 56.25 kHz. Therefore, for each FTR, the channel can be modeled as a constant complex coefficient independent of the frequency. Angel2 at sections 2.10, 2.11, 2.12:

'369 Patent	Project Angel
	2.10 Channel Estimation and Compensation The overall amplitude and phase distortion of a logical channel must be estimated and compensated for before the information transmitted on that channel can be recovered at the receiving end. This overall distortion includes the effect of radio propagation channels, as well as other factors such as phase noise from the local oscillator, IF filter frequency, synchronization errors, effects of power management loops, and thermal noise at the receiver. The overall distortion can be divided into two effective components: the frequency-independent component and the frequency-dependent component. For any logical channel, channel estimation and compensation is performed using pilot tones embedded in that channel. These pilot tones are referred to as link maintenance pilots (LMP). The location of LMP tones for different types of logical channels (voice, data, DAB, and NAC) is given in their respective tables in Section 2.7. For voice service, channel estimation and compensation are performed within a VFRT or hVFRT, whereas for HSD service, they are carried out within a DU. All of the LMPs with a VFRT, hVFRT or DU are used to estimate the overall distortion so as to cancel the its effect. **2.11 Automatic Gain Control** Automatic gain control (AGC) is required for maintaining the input levels, within an range, at the RU analog-to-digital converter (ADC). The AGC algorithm instructs the RU radio receiver to adjust the gain at both the RF and IF stages so as to: 1. Prevent clipping of the OFDM waveform 2. Maintain sufficient dynamic range to minimize the quantization noise in the analog-to-digital conversion A number of system parameters can be utilized by the AGC algorithm: 1.The strength of the time-keyed RSPs 2. The time-domain clip counts. **2.12 Radio Resource Management** **2.12.1 Dynamic Channel Allocation (DCA)** For voice service, an RU shall be allocated a voice channel when it requests to establish a call. A pool of voice channels within a subband will be dynamically allocated to those RUs that request a channel. Channel allocation is carried out via a DCA algorithm, which can be based on a number of metrics: 1.Receive signal strength indicator (RSSI) 2. Mean squared error (MSE) 3. Signal-to-interference-plus-noise ratio (SINR) When an RU requests a voice channel, the RU will communicate with Base via the NAC to report these metrics, based on which Base will allocate a usable channel available for the pool. Angel2 at 2.12.2

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<tr><th>’369 Patent</th><th>Project Angel</th></tr>
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2.12.2 Power Control

The function of power control is to manage Base and RU transmit power levels to provide the necessary quality of service (QoS) while maximizing overall system capacity. In providing these functions, power control is a means to
• Solve the near-end and far-end problems due to random RU locations in a service area
• Reduce co-channel interference by minimizing Base and RU transmitting power
• Mitigate long-term propagation channel variations such as shadowing and average path loss

Power control is implemented independently on the downlink and uplink for each logical channel as summarized in Table 2.12.38.

Table 2.12.38Power Control Applications

<table>
<tr><th>Logical Channel</th><th>Downlink</th><th>Uplink</th></tr>
<tr><td>Voice</td><td>Closed-loop</td><td>Closed-loop</td></tr>
<tr><td>HSD/NAC</td><td>TBD</td><td>TBD</td></tr>
</table>

For voice service, power control is in the form of closed-loop control for both uplink and downlink. It requires the Base Station and RU to exchange information. Power control algorithms are divided into different entities that reside on both the Base and RU. Two channel resources are allocated for facilitating the implementation of power control. When setting up a voice channel, the two entities talk with each other via the NAC. Once this particular voice channel has established, one bit in SACCH is used for updating the power control parameter until this voice channel is terminated.

One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants’ Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Channel Estimation and Tone Modification references. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
</td></tr>
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’369 Patent	Project Angel
1[a] identifying at least one multipath transmission delay within a reverse path data signal received from a receiving device;	Project Angel discloses identifying at least one multipath transmission delay within a reverse path data signal received from a receiving device. For example, see the following passages and/or figures, as well as all related disclosures: Angel1 at section 2.5.4: **2.5.4 Synchronization Channels** **2.5.4.1 Synchronization Channel Definition** The synchronization channel consists of the set of 18 pilot tones as defined in the frequency definition section. On the downlink, these tones serve as RU synchronization pilots (RSPs). On the uplink channel, the synchronization pilots are used for RU delay compensation. The uplink channel pilots are known as DCPs. The DCPs are activated by a single RU during a call set-up, or as requested by the Base, in order to estimate the processing and propagation delay adjustment necessary to align the new RU within the Base receive window. Angel1 at Section 2.9 Radio Frequency Propagation Environment:

’369 Patent	Project Angel
	2.9 Radio Frequency Propagation Environment The PWAN airlink is designed to support wireless local loop service. The OFDM waveform transmitted over the 1 MHz channel will undergo amplitude and phase distortions that are time-varying and frequency-selective in nature. Channel variations in time and frequency may be quantified by coherence time and bandwidth of the channel, respectively. Simulations based on propagation measurements for the wireless local loop service have shown the following: • **Coherence Time:** For 90% correlation, the coherence time is 15 ms, while for 50% correlation, the coherence time is 77 ms. Based on these numbers and the duration of TDMA slot (375 μsec), the channel can be considered to be a slowly fading channel; therefore, for each burst, the propagation channel can be modeled as a constant complex coefficient that does not vary with time. • **Coherence Bandwidth:** For 90% correlation, the coherence bandwidth is 265 kHz, while for 50% correlation, the coherence bandwidth is 875 kHz. Based on these numbers, the channel can be assumed to be flat for a frequency-time resource (FTR) with the bandwidth of 56.25 kHz. Therefore, for each FTR, the channel can be modeled as a constant complex coefficient independent of the frequency. Angel1 at Section 2.10:

'369 Patent	Project Angel
	2.10 Channel Estimation and Compensation The overall amplitude and phase distortion of a logical channel must be estimated and compensated for before the information transmitted on that channel can be recovered at the receiving end. This overall distortion includes the effect of radio propagation channels, as well as other factors such as phase noise from the local oscillator, IF filter frequency, synchronization errors, effects of power management loops, and thermal noise at the receiver. For any logical channel, channel estimation and compensation is performed using pilot tones embedded in that channel. These pilot tones are referred to as link maintenance pilots (LMP). The location of LMP tones for different types of logical channels (voice, data, DAB, and NAC) is given in their respective tables in Section 2.7. In TDMA slots with one LMP tone, the pilot tone is used to estimate the flat component of the distortion, i.e., the complex component of the distortion that is independent of frequency. In TDMA slots with more than one LMP tone, in addition to the flat component, the frequency-selective component of the distortion can also be estimated. These estimates may then be used to cancel the effect of overall distortion. Angell at Section 2.12: **2.12 Power Management** Overall system power management is provided through the Automatic Gain Control (AGC) and power control functions. AGC maintains input levels at the RU analog-to-digital converter (ADC) and power control manages Base and RU transmit levels. AGC and power control are interrelated; AGC operates independently, but one component of power control is dependent on the AGC settings. The following sections provide more detail on each set of algorithms. Angell at 2.12.2:

<table>
<tr><th>’369 Patent</th><th>Project Angel</th></tr>
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2.12.2 Power Control

Power control is part of Physical layer processing that manages Base and RU radio transmission levels to provide the necessary quality of service (QoS) while maximizing overall system capacity. In providing these functions, power control

- Solves the near-end and far-end problems due to random RU locations in a service area
- Reduces co-channel interference by minimizing Base and RU transmitting power
- Mitigates long-term propagation channel variations such as shadowing and average path loss

Power control is implemented independently on the downlink and uplink for each logical channel as summarized in Table 2.12.1.

Table 2.12.1 Power Control Applications

<table>
<tr><th>Logical Channel</th><th>Downlink</th><th>Uplink</th></tr>
<tr><td>Voice</td><td>Closed-loop</td><td>Closed-loop</td></tr>
<tr><td>HSD/NAC</td><td>No power control</td><td>Open-loop</td></tr>
</table>

Power control for voice is in the form of closed-loop control for both uplink and downlink. It requires the Base Station and RU to exchange information. The Base Station and RU each use voice performance metrics, specifically BLER and MSE, to determine transmission levels at both the Base and RU. HSD and NAC channels have no power control in the downlink, and operate with an open-loop power control in the uplink. Power control is applied on the uplink based on path loss information determined locally on the RU.

Power control algorithms are divided into different entities that reside on both the Base and RU as shown in Figure 2.12.2. Entities talk with each other via the NAC and the Physical Control Channel (PCC), which is a subset of the Associated Control Channel (ACC).

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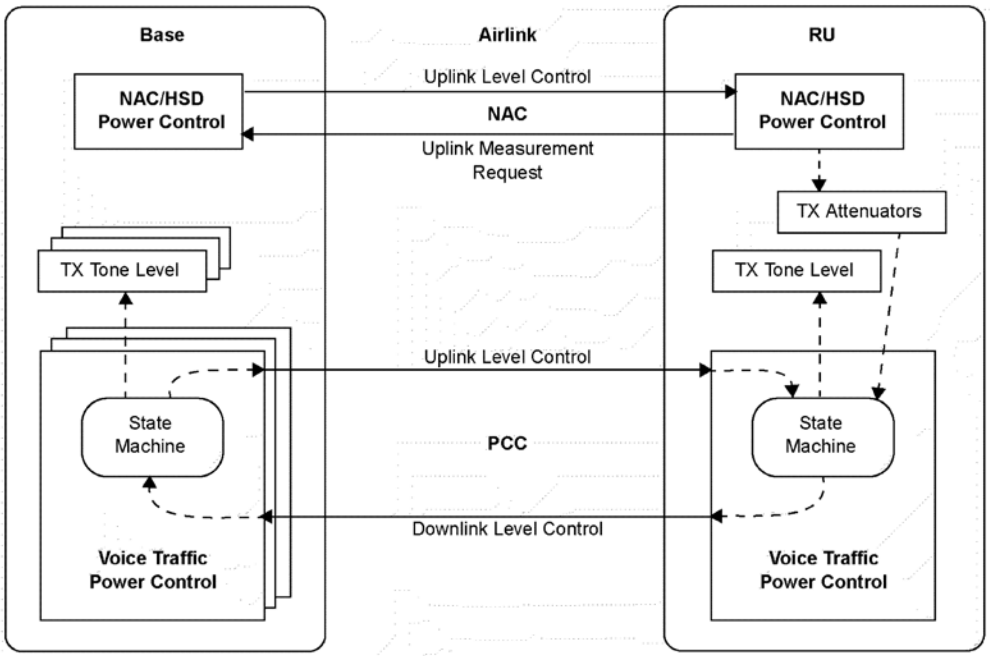
Exhibit E-10

<table>
<tr><th>’369 Patent</th><th>Project Angel</th></tr>
<tr><td></td><td>Figure 2.12.2 Base and RU Power Control Entities


ACC is the control channel of the voice traffic channel and is transmitted over the air within G.729E packets. Power control uses ACC to transmit and receive PCC messages, which deliver the downlink and uplink power level adjustments. PCC messages consists of a more bit field (1 bit), a header field (3 bits), a message type field (2 bits), a QPSK channel index field (1 bit), and a parameter data field (5 bits).</td></tr>
</table>

Exhibit E-10

<table>
<tr><th>’369 Patent</th><th>Project Angel</th></tr>
<tr><td></td><td>

Field	Size (bits)	Value
More bit	1	0
PCC Header	3	010
Message Type	2	00
QPSK Channel Index	1	0 or 1, based on QPSK cluster
Parameter Data	5	Power change bit field; 1 sign and 4 data bits. The first bit (MSB) of the PwrChgBitField is the sign bit. If it is set to 1, a message of decrementing power level is transmitted. The four LSBs of the PwrChgBitField contain the quantity of the power level adjustment with 1 dB resolution.

Angel1 at 2.12.2.2</td></tr>
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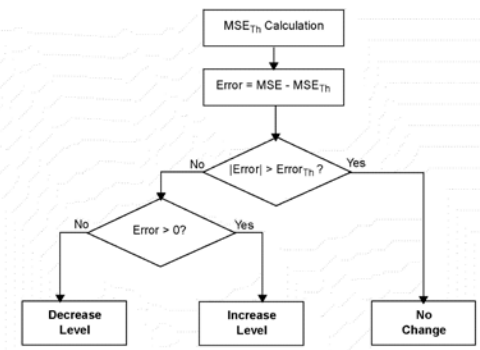
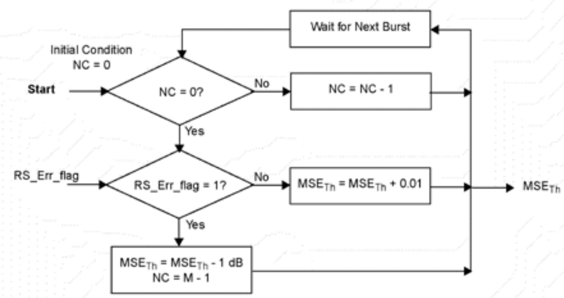
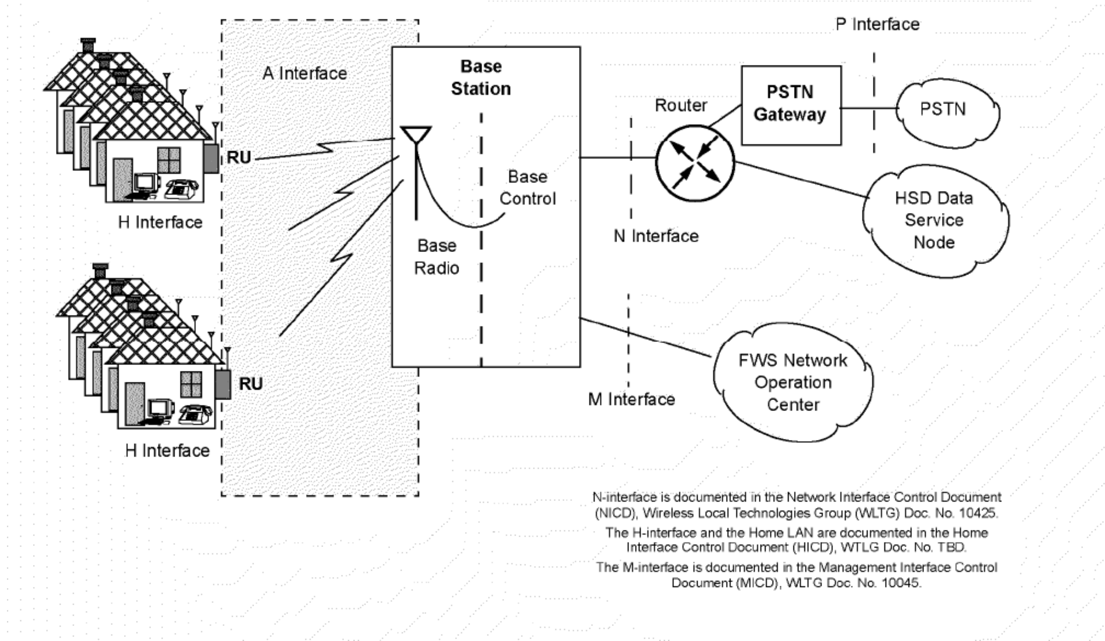
’369 Patent	Project Angel
	2.12.2.2 Voice Power Control A closed-loop algorithm is employed for downlink and uplink power control. In the downlink closed-loop power control scheme, the Base adjusts its transmitting power based on the power adjustment requests from the desired RU. In the uplink, the RU adjusts its transmitting power based on the feedback from its serving Base. The Base determines the power control command based on receiver performance. Transmit power is varied by changing the levels of the traffic tones. During call initialization, traffic tones are set at 10 dB below the maximum tone level to minimize interference to current calls, and are stepped up in 2-dB increments to the maximum level. After the ramp-up, tone levels are controlled to maintain a 1% BLER performance. The algorithm uses the traffic channel mean square error (MSE) to adjust the tone levels such that the target BLER is maintained. The difference between the calculated MSE and a reference MSE is continuously updated; if the difference exceeds a predetermined threshold, the transmitter is requested to change the traffic tone levels. Because the reference MSE is dependent on propagation channel conditions, the system employs an adaptive reference MSE. For the 1% BLER target, the MSE reference is increased by 0.01 dB at each measurement interval when there are no Reed-Solomon block errors. When a Reed-Solomon block error does occur, the MSE reference is decremented by 1 dB. The effect of this procedure is to keep tone levels adjusted to maintain the MSE corresponding to the target BLER. Figure 2.12.4 summarizes how the errors between actual and reference MSEs drive tone levels. Figure 2.12.5 shows how the adaptive MSE_{Th} is computed. On the downlink, the RU performs the MSE error and adaptive MSE reference calculations and requests the Base via the PCC to modify its transmit tone levels; likewise, the Base requests the RU to modify its uplink tone levels based on the receiver performance at the Base. Angel1 at Figures 2.12.4 and 2.12.5:

'369 Patent	Project Angel
	Figure 2.12.4 Closed-Loop Algorithm  *Figure 2.12.5 Adaptive MSE Reference Flowchart*  Angel2 at Figure 1.1

'369 Patent	Project Angel
	Figure 1.1 Fixed Wireless System Architecture  Angel2 at section 1.2

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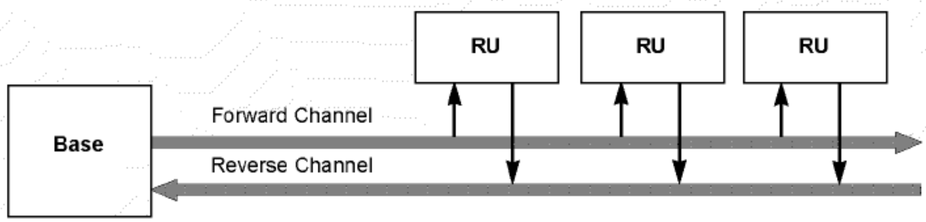
	The channel stream includes a forward channel from the Base Station to RU(s), and a reverse channel from RUs to the Base Station. *Figure 1.4 Model of Operation*  **Voice Service** Voice calls in a cell use available voice channels between RUs and the Base. Once voice channels are allocated for a call, those channels are dedicated to the voice call during the call period. **Data Service** The data forward channel is a contentionless broadcast channel carrying block transmissions from the Base Station. RU address information is received and decoded by all RUs on the channel simultaneously. If more than one RU is addressed then all addressed RUs receive and decode the channel data simultaneously. The data reverse channel is shared among all RUs; access arbitration and contention resolution is controlled by the Base Station using a Collision Free Multiple Access (CFMA) scheme. RUs arbitrate with the Base Station for the reverse channel using an orthogonal request mechanism. After the RU arbitration period, the Base Station grants access to the requesting RUs in a controlled manner. Angel2 at section 1.3

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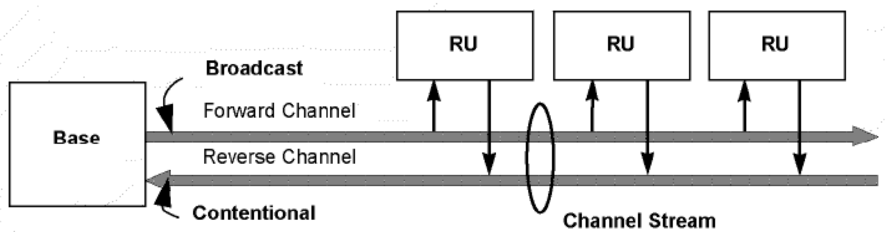
Figure 1.6 Data Physical Channel Relationships



Angel2 at section 1.5</td></tr>
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	2.2.1 Services Provided by the Physical Layer The Physical layer provides the following services to Voice and Data MAC layers as well as the VTch interface: • Transmission and reception of voice and data traffic • Transmission and reception of control information • Forward Error Control (FEC) and detection of messages corrupted during the transmission or reception process • RU frame and bit-level synchronization to global time references transmitted by the serving Base Station • Power control to minimize co-channel interference • Dynamic channel allocation for voice services • Collection of Physical layer performance metrics at both the Base and RU to support channel allocation, network optimization, and performance validation Angel2 at 2.4 “OFDM Resources” (entire section explaining usage of OFDM) Angel2 at ssection 2.5 “Logical Channel Description” (explaining usage of different subbands and of QPSK as recited in the dependent claims.

’369 Patent	Project Angel
	2.5 Logical Channel Descriptions **2.5.1 Channel Resource Mapping** Channel resources can be dynamically allocated to accommodate different voice and data needs for individual circumstances. Figure 2.5.16 and Figure 2.5.17 show the channel resource mapping for the data, voice and network access logical channels. Over each 1 MHz subband, N time slots are provisioned for high speed data service (slots ts_0-ts_{N-1}) and remaining (i.e., 20-N) time slots are provisioned for voice service (slots ts_N-ts_{19}), where N=10, 12,..., 18. That is, the number of time slots provisioned for data service can be increased from ten to a maximum of 18 at multiples of two, whereas the number of time slots provisioned for voice service can be reduced from ten to two. Network access channels occupy a portion of data time slots. The synchronization channel is comprised of 18 singular tones in the voice slots and two tones in the data slots. The logical channels, along with the synchronization channel are described in detail in the following sections. With this channel resource mapping, the HSD downlink raw data rate per sector is given in Table 2.5.7. *Table 2.5.7 HSD capacity per sector.* <table><tr><th></th><th>64 QAM</th><th>16 QAM</th><th>QPSK</th></tr><tr><td>Maximum (N=18)</td><td>3.3 Mbps</td><td>2.2 Mbps</td><td>1.1 Mbps</td></tr><tr><td>Minimum (N=10)</td><td>1.98 Mbps</td><td>1.32 Mbps</td><td>0.66 Mbps</td></tr></table> See section 2.6 on Space-Frequency Block Coding See section 2.7 on Coding:

'369 Patent	Project Angel
	2.7 Coding and Modulation The Physical layer uses coding and modulation for consistent transmission structures for FWS voice, data, and control channels. The transmission structures described in this section are for the steady-state period of a voice connection or a data burst. The transmission formats in this section are for the following channels: • Voice channel in 16-QAM mode • Voice channel in 64-QAM mode • Voice channel in QPSK mode • Data channel in 16 QAM mode • Data channel in 64 QAM mode • Data channel in QPSK mode • NAC • HCC All descriptions are for steady state operation. Angel2 at section 2.7.2.4 on QPSK voice. Angel2 at Section 2.9:

’369 Patent	Project Angel
	2.9 Radio-Frequency Signal Propagation Environment The FWS airlink is designed to support wireless local loop service. The OFDM waveform transmitted over the 1 MHz channel will undergo amplitude and phase distortions that are time-varying and frequency-selective in nature. Channel variations in time and frequency may be quantified by coherence time and bandwidth of the channel, respectively. Simulations based on propagation measurements for the wireless local loop service have shown the following: • **Coherence Time:** For 90% correlation, the coherence time is 15 ms, while for 50% correlation, the coherence time is 77 ms. Based on these numbers and the duration of TDMA slot (375 μsec), the channel can be considered to be a slowly fading channel; therefore, for each burst, the propagation channel can be modeled as a constant complex coefficient that does not vary with time. • **Coherence Bandwidth:** For 90% correlation, the coherence bandwidth is 265 kHz, while for 50% correlation, the coherence bandwidth is 875 kHz. Based on these numbers, the channel can be assumed to be flat for a frequency-time resource (FTR) with the bandwidth of 56.25 kHz. Therefore, for each FTR, the channel can be modeled as a constant complex coefficient independent of the frequency. Angel2 at sections 2.10, 2.11, 2.12:

'369 Patent	Project Angel
	2.10 Channel Estimation and Compensation The overall amplitude and phase distortion of a logical channel must be estimated and compensated for before the information transmitted on that channel can be recovered at the receiving end. This overall distortion includes the effect of radio propagation channels, as well as other factors such as phase noise from the local oscillator, IF filter frequency, synchronization errors, effects of power management loops, and thermal noise at the receiver. The overall distortion can be divided into two effective components: the frequency-independent component and the frequency-dependent component. For any logical channel, channel estimation and compensation is performed using pilot tones embedded in that channel. These pilot tones are referred to as link maintenance pilots (LMP). The location of LMP tones for different types of logical channels (voice, data, DAB, and NAC) is given in their respective tables in Section 2.7. For voice service, channel estimation and compensation are performed within a VFRT or hVFRT, whereas for HSD service, they are carried out within a DU. All of the LMPs with a VFRT, hVFRT or DU are used to estimate the overall distortion so as to cancel the its effect. **2.11 Automatic Gain Control** Automatic gain control (AGC) is required for maintaining the input levels, within an range, at the RU analog-to-digital converter (ADC). The AGC algorithm instructs the RU radio receiver to adjust the gain at both the RF and IF stages so as to: 1. Prevent clipping of the OFDM waveform 2. Maintain sufficient dynamic range to minimize the quantization noise in the analog-to-digital conversion A number of system parameters can be utilized by the AGC algorithm: 1.The strength of the time-keyed RSPs 2. The time-domain clip counts. **2.12 Radio Resource Management** **2.12.1 Dynamic Channel Allocation (DCA)** For voice service, an RU shall be allocated a voice channel when it requests to establish a call. A pool of voice channels within a subband will be dynamically allocated to those RUs that request a channel. Channel allocation is carried out via a DCA algorithm, which can be based on a number of metrics: 1.Receive signal strength indicator (RSSI) 2. Mean squared error (MSE) 3. Signal-to-interference-plus-noise ratio (SINR) When an RU requests a voice channel, the RU will communicate with Base via the NAC to report these metrics, based on which Base will allocate a usable channel available for the pool. Angel2 at 2.12.2

<table>
<tr><th>’369 Patent</th><th>Project Angel</th></tr>
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2.12.2 Power Control

The function of power control is to manage Base and RU transmit power levels to provide the necessary quality of service (QoS) while maximizing overall system capacity. In providing these functions, power control is a means to

- Solve the near-end and far-end problems due to random RU locations in a service area
- Reduce co-channel interference by minimizing Base and RU transmitting power
- Mitigate long-term propagation channel variations such as shadowing and average path loss

Power control is implemented independently on the downlink and uplink for each logical channel as summarized in Table 2.12.38.

Table 2.12.38Power Control Applications

<table>
<tr><th>Logical Channel</th><th>Downlink</th><th>Uplink</th></tr>
<tr><td>Voice</td><td>Closed-loop</td><td>Closed-loop</td></tr>
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For voice service, power control is in the form of closed-loop control for both uplink and downlink. It requires the Base Station and RU to exchange information. Power control algorithms are divided into different entities that reside on both the Base and RU. Two channel resources are allocated for facilitating the implementation of power control. When setting up a voice channel, the two entities talk with each other via the NAC. Once this particular voice channel has established, one bit in SACCH is used for updating the power control parameter until this voice channel is terminated.

One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants’ Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Channel Estimation references. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
</td></tr>
</table>

’369 Patent	Project Angel
1[b] determining at least one forward path pre-equalization parameter based on said at least one transmission delay; and	Project Angel discloses determining at least one forward path pre-equalization parameter based on said at least one transmission delay. For example, see the following passages and/or figures, as well as all related disclosures: Angel1 at section 2.5.4: **2.5.4 Synchronization Channels** **2.5.4.1 Synchronization Channel Definition** The synchronization channel consists of the set of 18 pilot tones as defined in the frequency definition section. On the downlink, these tones serve as RU synchronization pilots (RSPs). On the uplink channel, the synchronization pilots are used for RU delay compensation. The uplink channel pilots are known as DCPs. The DCPs are activated by a single RU during a call set-up, or as requested by the Base, in order to estimate the processing and propagation delay adjustment necessary to align the new RU within the Base receive window. Angel1 at Section 2.9 Radio Frequency Propagation Environment:

<table>
<tr><th>’369 Patent</th><th>Project Angel</th></tr>
<tr><td></td><td>

2.9 Radio Frequency Propagation Environment

The PWAN airlink is designed to support wireless local loop service. The OFDM waveform transmitted over the 1 MHz channel will undergo amplitude and phase distortions that are time-varying and frequency-selective in nature. Channel variations in time and frequency may be quantified by coherence time and bandwidth of the channel, respectively. Simulations based on propagation measurements for the wireless local loop service have shown the following:

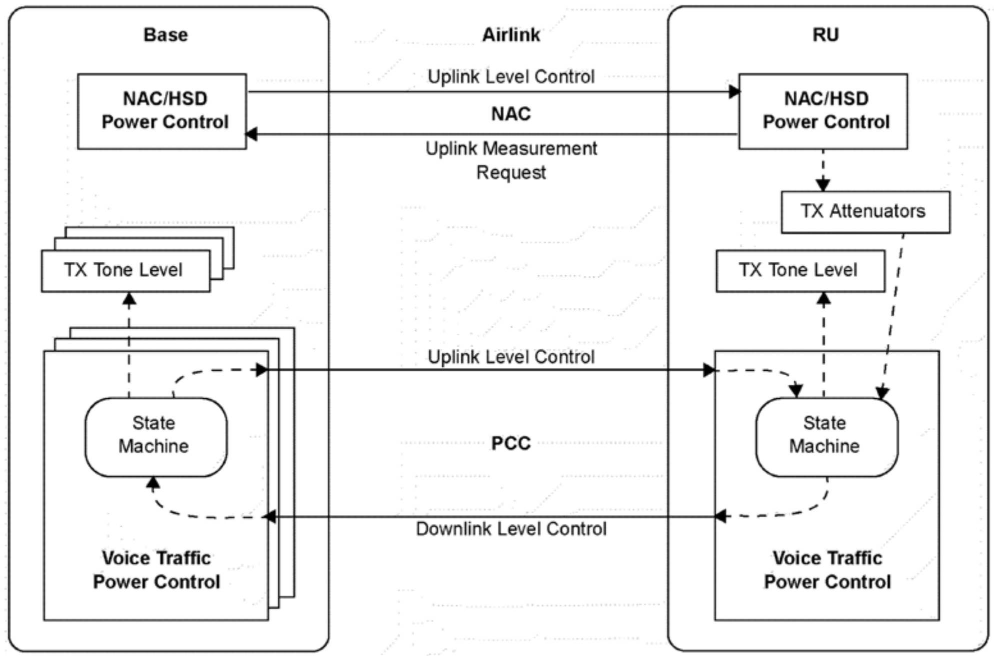
Coherence Time: For 90% correlation, the coherence time is 15 ms, while for 50% correlation, the coherence time is 77 ms. Based on these numbers and the duration of TDMA slot (375 μsec), the channel can be considered to be a slowly fading channel; therefore, for each burst, the propagation channel can be modeled as a constant complex coefficient that does not vary with time.
Coherence Bandwidth: For 90% correlation, the coherence bandwidth is 265 kHz, while for 50% correlation, the coherence bandwidth is 875 kHz. Based on these numbers, the channel can be assumed to be flat for a frequency-time resource (FTR) with the bandwidth of 56.25 kHz. Therefore, for each FTR, the channel can be modeled as a constant complex coefficient independent of the frequency.

Angel1 at Section 2.10:
</td></tr>
</table>

'369 Patent	Project Angel
	2.10 Channel Estimation and Compensation The overall amplitude and phase distortion of a logical channel must be estimated and compensated for before the information transmitted on that channel can be recovered at the receiving end. This overall distortion includes the effect of radio propagation channels, as well as other factors such as phase noise from the local oscillator, IF filter frequency, synchronization errors, effects of power management loops, and thermal noise at the receiver. For any logical channel, channel estimation and compensation is performed using pilot tones embedded in that channel. These pilot tones are referred to as link maintenance pilots (LMP). The location of LMP tones for different types of logical channels (voice, data, DAB, and NAC) is given in their respective tables in Section 2.7. In TDMA slots with one LMP tone, the pilot tone is used to estimate the flat component of the distortion, i.e., the complex component of the distortion that is independent of frequency. In TDMA slots with more than one LMP tone, in addition to the flat component, the frequency-selective component of the distortion can also be estimated. These estimates may then be used to cancel the effect of overall distortion. Angel1 at Section 2.12: **2.12 Power Management** Overall system power management is provided through the Automatic Gain Control (AGC) and power control functions. AGC maintains input levels at the RU analog-to-digital converter (ADC) and power control manages Base and RU transmit levels. AGC and power control are interrelated; AGC operates independently, but one component of power control is dependent on the AGC settings. The following sections provide more detail on each set of algorithms. Angel1 at 2.12.2:

’369 Patent	Project Angel
	2.12.2 Power Control Power control is part of Physical layer processing that manages Base and RU radio transmission levels to provide the necessary quality of service (QoS) while maximizing overall system capacity. In providing these functions, power control • Solves the near-end and far-end problems due to random RU locations in a service area • Reduces co-channel interference by minimizing Base and RU transmitting power • Mitigates long-term propagation channel variations such as shadowing and average path loss Power control is implemented independently on the downlink and uplink for each logical channel as summarized in Table 2.12.1. *Table 2.12.1 Power Control Applications* **Logical Channel** / **Downlink** / **Uplink** Voice / Closed-loop / Closed-loop HSD/NAC / No power control / Open-loop Power control for voice is in the form of closed-loop control for both uplink and downlink. It requires the Base Station and RU to exchange information. The Base Station and RU each use voice performance metrics, specifically BLER and MSE, to determine transmission levels at both the Base and RU. HSD and NAC channels have no power control in the downlink, and operate with an open-loop power control in the uplink. Power control is applied on the uplink based on path loss information determined locally on the RU. Power control algorithms are divided into different entities that reside on both the Base and RU as shown in Figure 2.12.2. Entities talk with each other via the NAC and the Physical Control Channel (PCC), which is a subset of the Associated Control Channel (ACC).

Exhibit E-10

'369 Patent	Project Angel
	Figure 2.12.2 Base and RU Power Control Entities  ACC is the control channel of the voice traffic channel and is transmitted over the air within G.729E packets. Power control uses ACC to transmit and receive PCC messages, which deliver the downlink and uplink power level adjustments. PCC messages consists of a more bit field (1 bit), a header field (3 bits), a message type field (2 bits), a QPSK channel index field (1 bit), and a parameter data field (5 bits).

<table>
<tr><th>’369 Patent</th><th>Project Angel</th></tr>
<tr><td></td><td>

Field	Size (bits)	Value
More bit	1	0
PCC Header	3	010
Message Type	2	00
QPSK Channel Index	1	0 or 1, based on QPSK cluster
Parameter Data	5	Power change bit field; 1 sign and 4 data bits. The first bit (MSB) of the PwrChgBitField is the sign bit. If it is set to 1, a message of decrementing power level is transmitted. The four LSBs of the PwrChgBitField contain the quantity of the power level adjustment with 1 dB resolution.

Angel1 at 2.12.2.2</td></tr>
</table>

<table>
<tr><th>’369 Patent</th><th>Project Angel</th></tr>
<tr><td></td><td>
2.12.2.2 Voice Power Control

A closed-loop algorithm is employed for downlink and uplink power control. In the downlink closed-loop power control scheme, the Base adjusts its transmitting power based on the power adjustment requests from the desired RU. In the uplink, the RU adjusts its transmitting power based on the feedback from its serving Base. The Base determines the power control command based on receiver performance.

Transmit power is varied by changing the levels of the traffic tones. During call initialization, traffic tones are set at 10 dB below the maximum tone level to minimize interference to current calls, and are stepped up in 2-dB increments to the maximum level. After the ramp-up, tone levels are controlled to maintain a 1% BLER performance. The algorithm uses the traffic channel mean square error (MSE) to adjust the tone levels such that the target BLER is maintained. The difference between the calculated MSE and a reference MSE is continuously updated; if the difference exceeds a predetermined threshold, the transmitter is requested to change the traffic tone levels. Because the reference MSE is dependent on propagation channel conditions, the system employs an adaptive reference MSE. For the 1% BLER target, the MSE reference is increased by 0.01 dB at each measurement interval when there are no Reed-Solomon block errors. When a Reed-Solomon block error does occur, the MSE reference is decremented by 1 dB. The effect of this procedure is to keep tone levels adjusted to maintain the MSE corresponding to the target BLER.

Figure 2.12.4 summarizes how the errors between actual and reference MSEs drive tone levels. Figure 2.12.5 shows how the adaptive MSE_{Th} is computed. On the downlink, the RU performs the MSE error and adaptive MSE reference calculations and requests the Base via the PCC to modify its transmit tone levels; likewise, the Base requests the RU to modify its uplink tone levels based on the receiver performance at the Base.

Angel1 at Figures 2.12.4 and 2.12.5:
</td></tr>
</table>

Exhibit E-10

<table>
<tr><th>’369 Patent</th><th>Project Angel</th></tr>
<tr><td></td><td>

Figure 2.12.4 Closed-Loop Algorithm

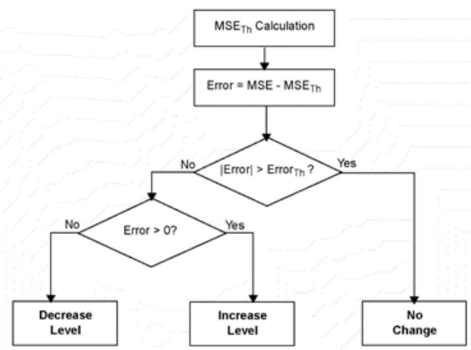
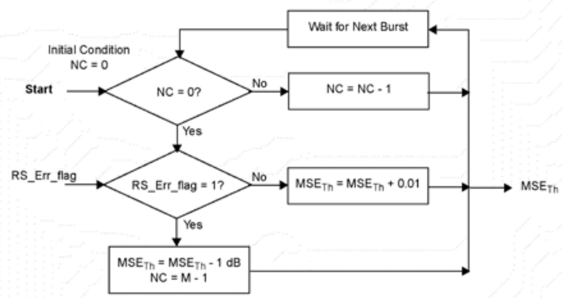


Figure 2.12.5 Adaptive MSE Reference Flowchart



Angel2 at Figure 1.1

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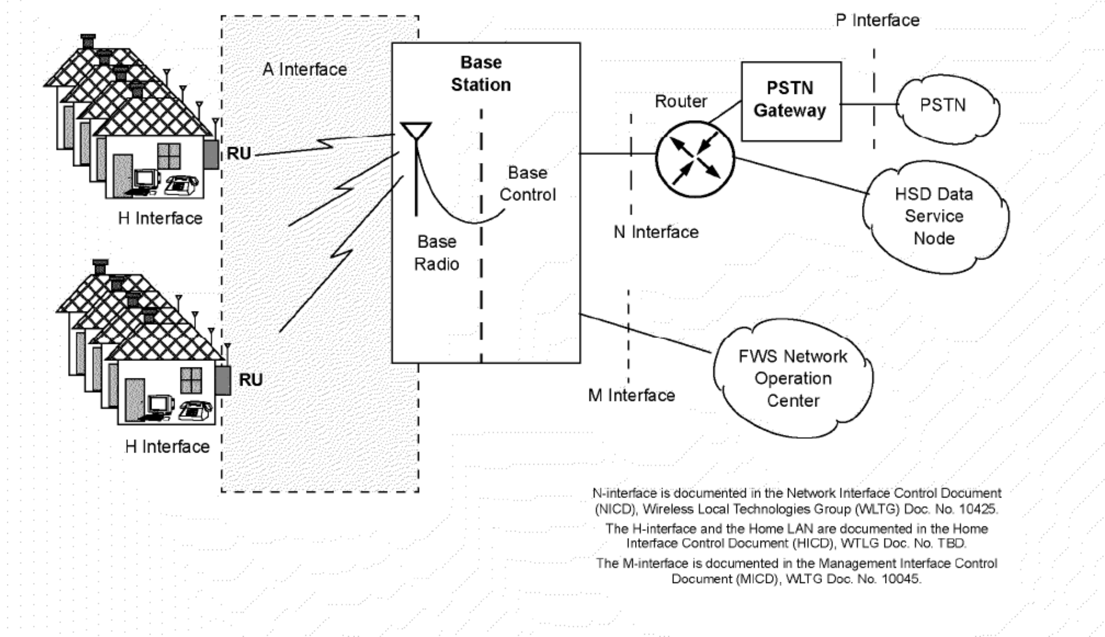
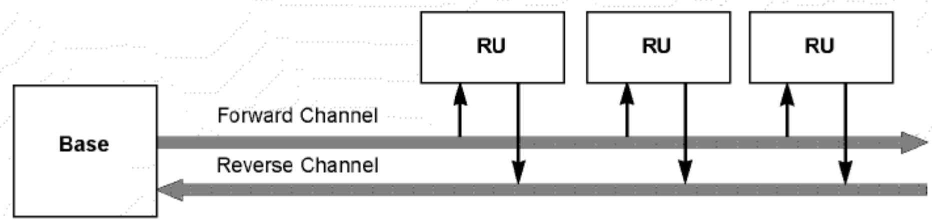
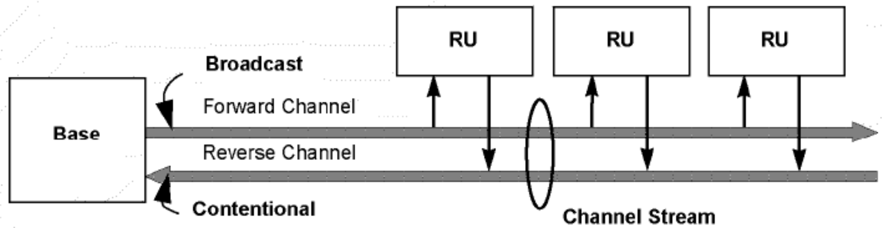
Exhibit E-10

'369 Patent	Project Angel
	Figure 1.1 Fixed Wireless System Architecture  Angel2 at section 1.2

'369 Patent	Project Angel
	The channel stream includes a forward channel from the Base Station to RU(s), and a reverse channel from RUs to the Base Station. *Figure 1.4 Model of Operation*  **Voice Service** Voice calls in a cell use available voice channels between RUs and the Base. Once voice channels are allocated for a call, those channels are dedicated to the voice call during the call period. **Data Service** The data forward channel is a contentionless broadcast channel carrying block transmissions from the Base Station. RU address information is received and decoded by all RUs on the channel simultaneously. If more than one RU is addressed then all addressed RUs receive and decode the channel data simultaneously. The data reverse channel is shared among all RUs; access arbitration and contention resolution is controlled by the Base Station using a Collision Free Multiple Access (CFMA) scheme. RUs arbitrate with the Base Station for the reverse channel using an orthogonal request mechanism. After the RU arbitration period, the Base Station grants access to the requesting RUs in a controlled manner. Angel2 at section 1.3

'369 Patent	Project Angel
	1.3 Physical Layer The Physical layer is the foundation of airlink communication over which all voice, data, and information/control signals are actually transmitted. The Physical layer is based on an Orthogonal Frequency Division Multiplexed (OFDM) waveform comprised of multiple frequency domain channels. Each frequency channel is further subdivided into Time Division Multiple Access (TDMA) time slots. A TDMA time slot on a frequency domain channel is referred to as a physical channel. Logical channels are formed using physical channels, either separately or aggregated for high bit rates. Voice and HSD share the same physical airlink. The Physical layer of the OSI architecture provides the following services: • Transmission and reception of voice and data traffic • Transmission and reception of control information over the logical control channels between the RU and the Base • Error detection and Forward Error Correction (FEC) for messages corrupted during the transmission or reception process • RU frame and symbol-level synchronization to global time references transmitted by the serving Base Station • Power control to minimize cochannel interference Angel2 at section 1.3.2 HSD Channel Characterstics.

’369 Patent	Project Angel
	The physical channels assigned to an RU constitute a “channel stream” that provides full duplex data communications capability between a Base and RU. The physical channels assigned to carry Base-to-RU traffic constitute the “forward channel” and those carrying RU-to-Base traffic constitute the “reverse channel.” Forward channel and reverse channel capacities may differ. These relationships are illustrated in Figure 1.6. *Figure 1.6 Data Physical Channel Relationships*  Angel2 at section 1.5

<table>
<tr><th>’369 Patent</th><th>Project Angel</th></tr>
<tr><td></td><td>
HSD Medium Access Control (DMAC)

The DMAC layer provides orderly and efficient use of the airlink Physical layer for the HTL. The DMAC layer provides
• Medium access control
• Channel status insertion
• Error correction encoding
• Frame recognition, and error detection/recovery services

HSD Transport Layer (HTL)

The transport layer provides reliable, session-oriented, error-free data airlink connections. In the upper layer interface, HTL multiplexes packets from applications into a single data link connection, and demultiplexes them in the reverse direction. In the lower layer interface, HTL uses the service provided by the device driver to deliver/receive packets to/from the airlink. HTL provides
• Provisioning and support of multiple RUs sharing access to a single physical medium
• Error detection and recovery
• Flow control
• Sequence control
• Multiple Types Of Service (TOS)
• Segmentation, assembly, and reassembly (SAR)
• Encryption and decryption

Angel2 at 2.1 (use of OFDM).

Angel2 at 2.2.1:
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2.2.1 Services Provided by the Physical Layer

The Physical layer provides the following services to Voice and Data MAC layers as well as the VTch interface:

Transmission and reception of voice and data traffic
Transmission and reception of control information
Forward Error Control (FEC) and detection of messages corrupted during the transmission or reception process
RU frame and bit-level synchronization to global time references transmitted by the serving Base Station
Power control to minimize co-channel interference
Dynamic channel allocation for voice services
Collection of Physical layer performance metrics at both the Base and RU to support channel allocation, network optimization, and performance validation

Angel2 at 2.4 “OFDM Resources” (entire section explaining usage of OFDM)

Angel2 at ssection 2.5 “Logical Channel Description” (explaining usage of different subbands and of QPSK as recited in the dependent claims.

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<h3>2.5.1 Channel Resource Mapping</h3>
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</table>
See section 2.6 on Space-Frequency Block Coding
See section 2.7 on Coding:
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The transmission formats in this section are for the following channels:

Voice channel in 16-QAM mode
Voice channel in 64-QAM mode
Voice channel in QPSK mode
Data channel in 16 QAM mode
Data channel in 64 QAM mode
Data channel in QPSK mode
NAC
HCC

All descriptions are for steady state operation.
Angel2 at section 2.7.2.4 on QPSK voice.
Angel2 at Section 2.9:
</td></tr>
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<tr><th>’369 Patent</th><th>Project Angel</th></tr>
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<h2>2.9 Radio-Frequency Signal Propagation Environment</h2>
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Coherence Time: For 90% correlation, the coherence time is 15 ms, while for 50% correlation, the coherence time is 77 ms. Based on these numbers and the duration of TDMA slot (375 μsec), the channel can be considered to be a slowly fading channel; therefore, for each burst, the propagation channel can be modeled as a constant complex coefficient that does not vary with time.
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Angel2 at sections 2.10, 2.11, 2.12:
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Exhibit E-10

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<tr><td>HSD/NAC</td><td>TBD</td><td>TBD</td></tr>
</table>

For voice service, power control is in the form of closed-loop control for both uplink and downlink. It requires the Base Station and RU to exchange information. Power control algorithms are divided into different entities that reside on both the Base and RU. Two channel resources are allocated for facilitating the implementation of power control. When setting up a voice channel, the two entities talk with each other via the NAC. Once this particular voice channel has established, one bit in SACCH is used for updating the power control parameter until this voice channel is terminated.

One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants’ Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Channel Estimation references.. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
</td></tr>
</table>

’369 Patent	Project Angel
1[c] modifying a forward path data signal that is to be transmitted to the receiving device based on said at least one forward path pre-equalization parameter, where said modifying includes selectively setting different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal.	Project Angel discloses modifying a forward path data signal that is to be transmitted to the receiving device based on said at least one forward path pre-equalization parameter, where said modifying includes selectively setting different transmission power levels for at least two Orthogonal Frequency Division Multiplexing (OFDM) tones in said forward path data signal. For example, see the following passages and/or figures, as well as all related disclosures: Angel1 at section 2.5.4: **2.5.4 Synchronization Channels** **2.5.4.1 Synchronization Channel Definition** The synchronization channel consists of the set of 18 pilot tones as defined in the frequency definition section. On the downlink, these tones serve as RU synchronization pilots (RSPs). On the uplink channel, the synchronization pilots are used for RU delay compensation. The uplink channel pilots are known as DCPs. The DCPs are activated by a single RU during a call set-up, or as requested by the Base, in order to estimate the processing and propagation delay adjustment necessary to align the new RU within the Base receive window. Angel1 at Section 2.9 Radio Frequency Propagation Environment:

<table>
<tr><th>’369 Patent</th><th>Project Angel</th></tr>
<tr><td></td><td>
2.9 Radio Frequency Propagation Environment

The PWAN airlink is designed to support wireless local loop service. The OFDM waveform transmitted over the 1 MHz channel will undergo amplitude and phase distortions that are time-varying and frequency-selective in nature. Channel variations in time and frequency may be quantified by coherence time and bandwidth of the channel, respectively. Simulations based on propagation measurements for the wireless local loop service have shown the following:

• Coherence Time: For 90% correlation, the coherence time is 15 ms, while for 50% correlation, the coherence time is 77 ms. Based on these numbers and the duration of TDMA slot (375 μsec), the channel can be considered to be a slowly fading channel; therefore, for each burst, the propagation channel can be modeled as a constant complex coefficient that does not vary with time.
• Coherence Bandwidth: For 90% correlation, the coherence bandwidth is 265 kHz, while for 50% correlation, the coherence bandwidth is 875 kHz. Based on these numbers, the channel can be assumed to be flat for a frequency-time resource (FTR) with the bandwidth of 56.25 kHz. Therefore, for each FTR, the channel can be modeled as a constant complex coefficient independent of the frequency.

Angel1 at Section 2.10:
</td></tr>
</table>

'369 Patent	Project Angel
	2.10 Channel Estimation and Compensation The overall amplitude and phase distortion of a logical channel must be estimated and compensated for before the information transmitted on that channel can be recovered at the receiving end. This overall distortion includes the effect of radio propagation channels, as well as other factors such as phase noise from the local oscillator, IF filter frequency, synchronization errors, effects of power management loops, and thermal noise at the receiver. For any logical channel, channel estimation and compensation is performed using pilot tones embedded in that channel. These pilot tones are referred to as link maintenance pilots (LMP). The location of LMP tones for different types of logical channels (voice, data, DAB, and NAC) is given in their respective tables in Section 2.7. In TDMA slots with one LMP tone, the pilot tone is used to estimate the flat component of the distortion, i.e., the complex component of the distortion that is independent of frequency. In TDMA slots with more than one LMP tone, in addition to the flat component, the frequency-selective component of the distortion can also be estimated. These estimates may then be used to cancel the effect of overall distortion. Angel1 at Section 2.12: **2.12 Power Management** Overall system power management is provided through the Automatic Gain Control (AGC) and power control functions. AGC maintains input levels at the RU analog-to-digital converter (ADC) and power control manages Base and RU transmit levels. AGC and power control are interrelated; AGC operates independently, but one component of power control is dependent on the AGC settings. The following sections provide more detail on each set of algorithms. Angel1 at 2.12.2:

<table>
<tr><th>’369 Patent</th><th>Project Angel</th></tr>
<tr><td></td><td>

2.12.2 Power Control

Power control is part of Physical layer processing that manages Base and RU radio transmission levels to provide the necessary quality of service (QoS) while maximizing overall system capacity. In providing these functions, power control

- Solves the near-end and far-end problems due to random RU locations in a service area
- Reduces co-channel interference by minimizing Base and RU transmitting power
- Mitigates long-term propagation channel variations such as shadowing and average path loss

Power control is implemented independently on the downlink and uplink for each logical channel as summarized in Table 2.12.1.

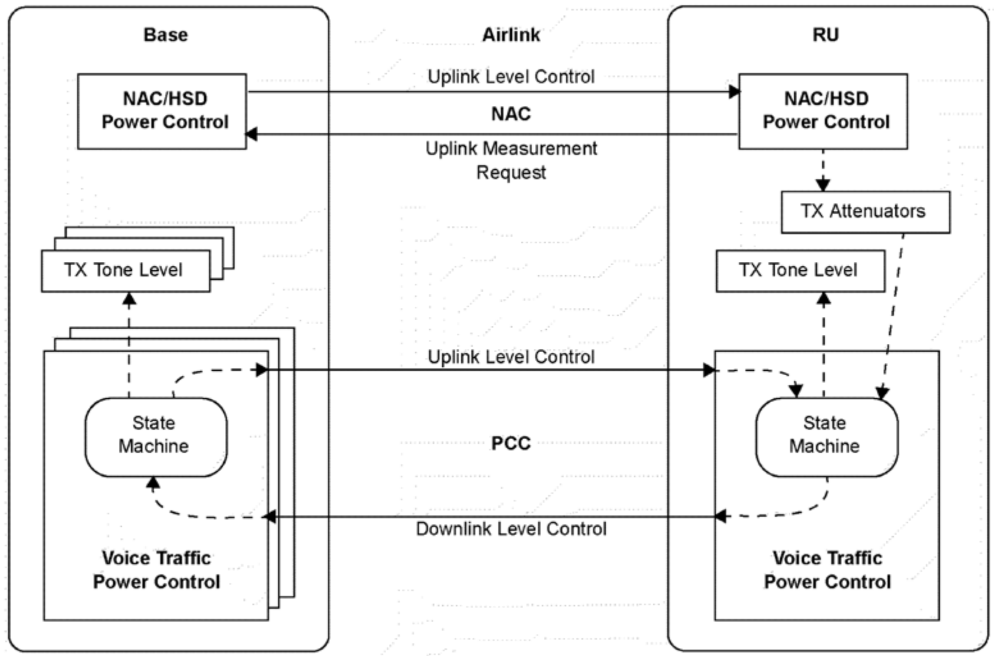
Table 2.12.1 Power Control Applications

<table>
<tr><th>Logical Channel</th><th>Downlink</th><th>Uplink</th></tr>
<tr><td>Voice</td><td>Closed-loop</td><td>Closed-loop</td></tr>
<tr><td>HSD/NAC</td><td>No power control</td><td>Open-loop</td></tr>
</table>

Power control for voice is in the form of closed-loop control for both uplink and downlink. It requires the Base Station and RU to exchange information. The Base Station and RU each use voice performance metrics, specifically BLER and MSE, to determine transmission levels at both the Base and RU. HSD and NAC channels have no power control in the downlink, and operate with an open-loop power control in the uplink. Power control is applied on the uplink based on path loss information determined locally on the RU.

Power control algorithms are divided into different entities that reside on both the Base and RU as shown in Figure 2.12.2. Entities talk with each other via the NAC and the Physical Control Channel (PCC), which is a subset of the Associated Control Channel (ACC).

</td></tr>
</table>

'369 Patent	Project Angel
	Figure 2.12.2 Base and RU Power Control Entities  ACC is the control channel of the voice traffic channel and is transmitted over the air within G.729E packets. Power control uses ACC to transmit and receive PCC messages, which deliver the downlink and uplink power level adjustments. PCC messages consists of a more bit field (1 bit), a header field (3 bits), a message type field (2 bits), a QPSK channel index field (1 bit), and a parameter data field (5 bits).

<table>
<tr><th>’369 Patent</th><th>Project Angel</th></tr>
<tr><td></td><td>

Field	Size (bits)	Value
More bit	1	0
PCC Header	3	010
Message Type	2	00
QPSK Channel Index	1	0 or 1, based on QPSK cluster
Parameter Data	5	Power change bit field; 1 sign and 4 data bits. The first bit (MSB) of the PwrChgBitField is the sign bit. If it is set to 1, a message of decrementing power level is transmitted. The four LSBs of the PwrChgBitField contain the quantity of the power level adjustment with 1 dB resolution.

Angel1 at 2.12.2.2</td></tr>
</table>

'369 Patent	Project Angel
	2.12.2.2 Voice Power Control A closed-loop algorithm is employed for downlink and uplink power control. In the downlink closed-loop power control scheme, the Base adjusts its transmitting power based on the power adjustment requests from the desired RU. In the uplink, the RU adjusts its transmitting power based on the feedback from its serving Base. The Base determines the power control command based on receiver performance. Transmit power is varied by changing the levels of the traffic tones. During call initialization, traffic tones are set at 10 dB below the maximum tone level to minimize interference to current calls, and are stepped up in 2-dB increments to the maximum level. After the ramp-up, tone levels are controlled to maintain a 1% BLER performance. The algorithm uses the traffic channel mean square error (MSE) to adjust the tone levels such that the target BLER is maintained. The difference between the calculated MSE and a reference MSE is continuously updated; if the difference exceeds a predetermined threshold, the transmitter is requested to change the traffic tone levels. Because the reference MSE is dependent on propagation channel conditions, the system employs an adaptive reference MSE. For the 1% BLER target, the MSE reference is increased by 0.01 dB at each measurement interval when there are no Reed-Solomon block errors. When a Reed-Solomon block error does occur, the MSE reference is decremented by 1 dB. The effect of this procedure is to keep tone levels adjusted to maintain the MSE corresponding to the target BLER. Figure 2.12.4 summarizes how the errors between actual and reference MSEs drive tone levels. Figure 2.12.5 shows how the adaptive MSE_{Th} is computed. On the downlink, the RU performs the MSE error and adaptive MSE reference calculations and requests the Base via the PCC to modify its transmit tone levels; likewise, the Base requests the RU to modify its uplink tone levels based on the receiver performance at the Base. Angel1 at Figures 2.12.4 and 2.12.5:

Exhibit E-10

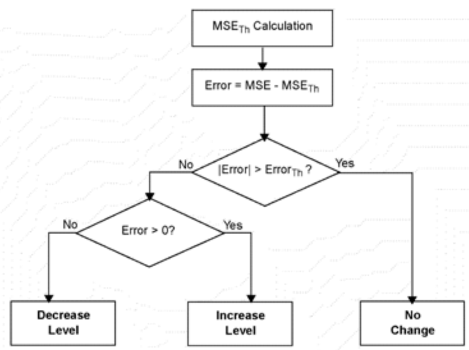
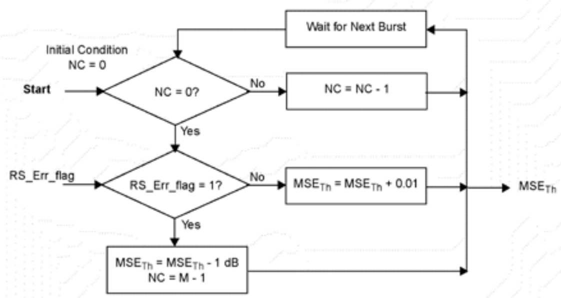
’369 Patent	Project Angel
	Figure 2.12.4 Closed-Loop Algorithm  *Figure 2.12.5 Adaptive MSE Reference Flowchart*  Angel2 at Figure 1.1

Exhibit E-10

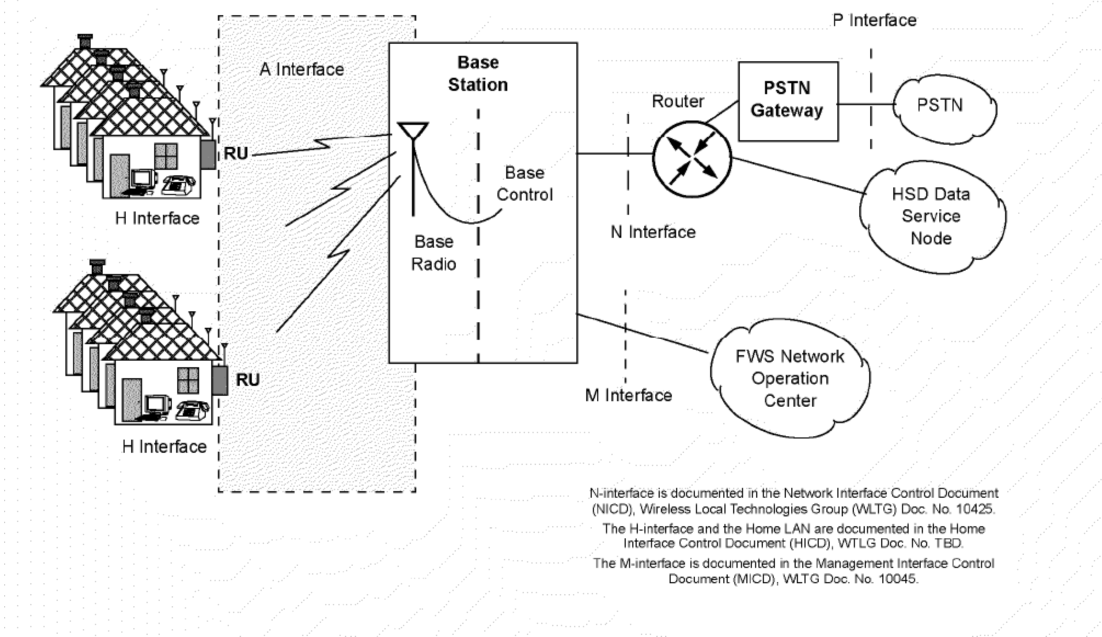
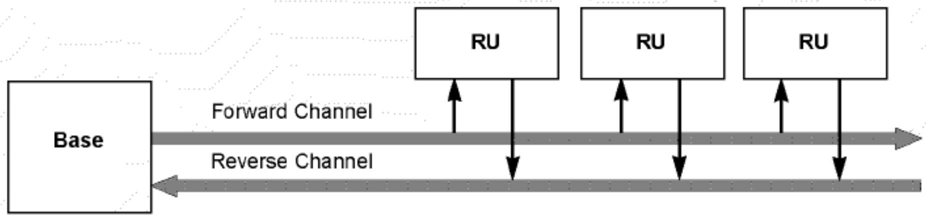
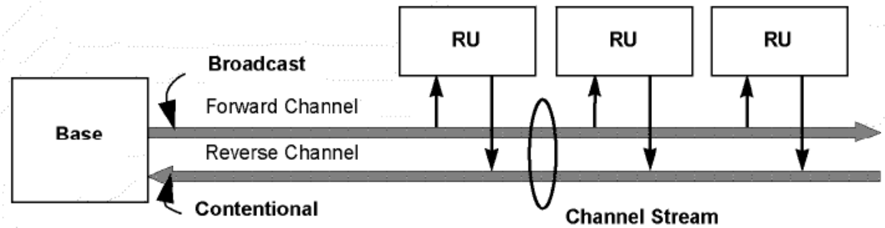
’369 Patent	Project Angel
	Figure 1.1 Fixed Wireless System Architecture  Angel2 at section 1.2

Exhibit E-10

'369 Patent	Project Angel
	The channel stream includes a forward channel from the Base Station to RU(s), and a reverse channel from RUs to the Base Station. *Figure 1.4 Model of Operation*  **Voice Service** Voice calls in a cell use available voice channels between RUs and the Base. Once voice channels are allocated for a call, those channels are dedicated to the voice call during the call period. **Data Service** The data forward channel is a contentionless broadcast channel carrying block transmissions from the Base Station. RU address information is received and decoded by all RUs on the channel simultaneously. If more than one RU is addressed then all addressed RUs receive and decode the channel data simultaneously. The data reverse channel is shared among all RUs; access arbitration and contention resolution is controlled by the Base Station using a Collision Free Multiple Access (CFMA) scheme. RUs arbitrate with the Base Station for the reverse channel using an orthogonal request mechanism. After the RU arbitration period, the Base Station grants access to the requesting RUs in a controlled manner. Angel2 at section 1.3

'369 Patent	Project Angel
	1.3 Physical Layer The Physical layer is the foundation of airlink communication over which all voice, data, and information/control signals are actually transmitted. The Physical layer is based on an Orthogonal Frequency Division Multiplexed (OFDM) waveform comprised of multiple frequency domain channels. Each frequency channel is further subdivided into Time Division Multiple Access (TDMA) time slots. A TDMA time slot on a frequency domain channel is referred to as a physical channel. Logical channels are formed using physical channels, either separately or aggregated for high bit rates. Voice and HSD share the same physical airlink. The Physical layer of the OSI architecture provides the following services: • Transmission and reception of voice and data traffic • Transmission and reception of control information over the logical control channels between the RU and the Base • Error detection and Forward Error Correction (FEC) for messages corrupted during the transmission or reception process • RU frame and symbol-level synchronization to global time references transmitted by the serving Base Station • Power control to minimize cochannel interference Angel2 at section 1.3.2 HSD Channel Characterstics.

'369 Patent	Project Angel
	The physical channels assigned to an RU constitute a "channel stream" that provides full duplex data communications capability between a Base and RU. The physical channels assigned to carry Base-to-RU traffic constitute the "forward channel" and those carrying RU-to-Base traffic constitute the "reverse channel." Forward channel and reverse channel capacities may differ. These relationships are illustrated in Figure 1.6. *Figure 1.6 Data Physical Channel Relationships*  Angel2 at section 1.5

'369 Patent	Project Angel
	HSD Medium Access Control (DMAC) The DMAC layer provides orderly and efficient use of the airlink Physical layer for the HTL. The DMAC layer provides • Medium access control • Channel status insertion • Error correction encoding • Frame recognition, and error detection/recovery services **HSD Transport Layer (HTL)** The transport layer provides reliable, session-oriented, error-free data airlink connections. In the upper layer interface, HTL multiplexes packets from applications into a single data link connection, and demultiplexes them in the reverse direction. In the lower layer interface, HTL uses the service provided by the device driver to deliver/receive packets to/from the airlink. HTL provides • Provisioning and support of multiple RUs sharing access to a single physical medium • Error detection and recovery • Flow control • Sequence control • Multiple Types Of Service (TOS) • Segmentation, assembly, and reassembly (SAR) • Encryption and decryption Angel2 at 2.1 (use of OFDM). Angel2 at 2.2.1:

’369 Patent	Project Angel
	2.2.1 Services Provided by the Physical Layer The Physical layer provides the following services to Voice and Data MAC layers as well as the VTch interface: • Transmission and reception of voice and data traffic • Transmission and reception of control information • Forward Error Control (FEC) and detection of messages corrupted during the transmission or reception process • RU frame and bit-level synchronization to global time references transmitted by the serving Base Station • Power control to minimize co-channel interference • Dynamic channel allocation for voice services • Collection of Physical layer performance metrics at both the Base and RU to support channel allocation, network optimization, and performance validation Angel2 at 2.4 “OFDM Resources” (entire section explaining usage of OFDM) Angel2 at ssection 2.5 “Logical Channel Description” (explaining usage of different subbands and of QPSK as recited in the dependent claims.

Exhibit E-10

<table>
<tr><th>’369 Patent</th><th>Project Angel</th></tr>
<tr><td></td><td>

2.5 Logical Channel Descriptions

2.5.1 Channel Resource Mapping

Channel resources can be dynamically allocated to accommodate different voice and data needs for individual circumstances. Figure 2.5.16 and Figure 2.5.17 show the channel resource mapping for the data, voice and network access logical channels. Over each 1 MHz subband, N time slots are provisioned for high speed data service (slots ts_0-ts_{N-1}) and remaining (i.e., 20-N) time slots are provisioned for voice service (slots ts_N-ts_{19}), where N=10, 12,..., 18. That is, the number of time slots provisioned for data service can be increased from ten to a maximum of 18 at multiples of two, whereas the number of time slots provisioned for voice service can be reduced from ten to two. Network access channels occupy a portion of data time slots. The synchronization channel is comprised of 18 singular tones in the voice slots and two tones in the data slots. The logical channels, along with the synchronization channel are described in detail in the following sections. With this channel resource mapping, the HSD downlink raw data rate per sector is given in Table 2.5.7.

Table 2.5.7 HSD capacity per sector.

	64 QAM	16 QAM	QPSK
Maximum (N=18)	3.3 Mbps	2.2 Mbps	1.1 Mbps
Minimum (N=10)	1.98 Mbps	1.32 Mbps	0.66 Mbps

See section 2.6 on Space-Frequency Block Coding

See section 2.7 on Coding:

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<tr><th>'369 Patent</th><th>Project Angel</th></tr>
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<h2>2.7 Coding and Modulation</h2>

The Physical layer uses coding and modulation for consistent transmission structures for FWS voice, data, and control channels. The transmission structures described in this section are for the steady-state period of a voice connection or a data burst.

The transmission formats in this section are for the following channels:

Voice channel in 16-QAM mode
Voice channel in 64-QAM mode
Voice channel in QPSK mode
Data channel in 16 QAM mode
Data channel in 64 QAM mode
Data channel in QPSK mode
NAC
HCC

All descriptions are for steady state operation.

Angel2 at section 2.7.2.4 on QPSK voice.

Angel2 at Section 2.9:

</td></tr>
</table>

'369 Patent	Project Angel
	2.9 Radio-Frequency Signal Propagation Environment The FWS airlink is designed to support wireless local loop service. The OFDM waveform transmitted over the 1 MHz channel will undergo amplitude and phase distortions that are time-varying and frequency-selective in nature. Channel variations in time and frequency may be quantified by coherence time and bandwidth of the channel, respectively. Simulations based on propagation measurements for the wireless local loop service have shown the following: • **Coherence Time:** For 90% correlation, the coherence time is 15 ms, while for 50% correlation, the coherence time is 77 ms. Based on these numbers and the duration of TDMA slot (375 µsec), the channel can be considered to be a slowly fading channel; therefore, for each burst, the propagation channel can be modeled as a constant complex coefficient that does not vary with time. • **Coherence Bandwidth:** For 90% correlation, the coherence bandwidth is 265 kHz, while for 50% correlation, the coherence bandwidth is 875 kHz. Based on these numbers, the channel can be assumed to be flat for a frequency-time resource (FTR) with the bandwidth of 56.25 kHz. Therefore, for each FTR, the channel can be modeled as a constant complex coefficient independent of the frequency. Angel2 at sections 2.10, 2.11, 2.12:

<table>
<tr><th>’369 Patent</th><th>Project Angel</th></tr>
<tr><td></td><td>

2.10 Channel Estimation and Compensation

The overall amplitude and phase distortion of a logical channel must be estimated and compensated for before the information transmitted on that channel can be recovered at the receiving end. This overall distortion includes the effect of radio propagation channels, as well as other factors such as phase noise from the local oscillator, IF filter frequency, synchronization errors, effects of power management loops, and thermal noise at the receiver. The overall distortion can be divided into two effective components: the frequency-independent component and the frequency-dependent component.

For any logical channel, channel estimation and compensation is performed using pilot tones embedded in that channel. These pilot tones are referred to as link maintenance pilots (LMP). The location of LMP tones for different types of logical channels (voice, data, DAB, and NAC) is given in their respective tables in Section 2.7.

For voice service, channel estimation and compensation are performed within a VFRT or hVFRT, whereas for HSD service, they are carried out within a DU. All of the LMPs with a VFRT, hVFRT or DU are used to estimate the overall distortion so as to cancel the its effect.

2.11 Automatic Gain Control

Automatic gain control (AGC) is required for maintaining the input levels, within an range, at the RU analog-to-digital converter (ADC). The AGC algorithm instructs the RU radio receiver to adjust the gain at both the RF and IF stages so as to:

1. Prevent clipping of the OFDM waveform
2. Maintain sufficient dynamic range to minimize the quantization noise in the analog-to-digital conversion

A number of system parameters can be utilized by the AGC algorithm:

1.The strength of the time-keyed RSPs
2. The time-domain clip counts.

2.12 Radio Resource Management

2.12.1 Dynamic Channel Allocation (DCA)

For voice service, an RU shall be allocated a voice channel when it requests to establish a call. A pool of voice channels within a subband will be dynamically allocated to those RUs that request a channel. Channel allocation is carried out via a DCA algorithm, which can be based on a number of metrics:

1.Receive signal strength indicator (RSSI)
2. Mean squared error (MSE)
3. Signal-to-interference-plus-noise ratio (SINR)

When an RU requests a voice channel, the RU will communicate with Base via the NAC to report these metrics, based on which Base will allocate a usable channel available for the pool.

Angel2 at 2.12.2
</td></tr>
</table>

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<tr><th>’369 Patent</th><th>Project Angel</th></tr>
<tr><td></td><td>

2.12.2 Power Control

The function of power control is to manage Base and RU transmit power levels to provide the necessary quality of service (QoS) while maximizing overall system capacity. In providing these functions, power control is a means to

Solve the near-end and far-end problems due to random RU locations in a service area
Reduce co-channel interference by minimizing Base and RU transmitting power
Mitigate long-term propagation channel variations such as shadowing and average path loss

Power control is implemented independently on the downlink and uplink for each logical channel as summarized in Table 2.12.38.

Table 2.12.38Power Control Applications

<table>
<tr><th>Logical Channel</th><th>Downlink</th><th>Uplink</th></tr>
<tr><td>Voice</td><td>Closed-loop</td><td>Closed-loop</td></tr>
<tr><td>HSD/NAC</td><td>TBD</td><td>TBD</td></tr>
</table>

For voice service, power control is in the form of closed-loop control for both uplink and downlink. It requires the Base Station and RU to exchange information. Power control algorithms are divided into different entities that reside on both the Base and RU. Two channel resources are allocated for facilitating the implementation of power control. When setting up a voice channel, the two entities talk with each other via the NAC. Once this particular voice channel has established, one bit in SACCH is used for updating the power control parameter until this voice channel is terminated.

One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants’ Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the OFDM Tone Modification references. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
</td></tr>
</table>

'369 Patent	Project Angel
2. The method as recited in claim 1, further comprising: receiving said reverse path data signal over at least one reverse transmission path.	Project Angel discloses receiving said reverse path data signal over at least one reverse transmission path. For example, see the following passages and/or figures, as well as all related disclosures: See discussion of 1[p], 1[a] describing reverse path transmissions (uplink to base station) and signals sent thereon such as the "feedback" signal. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Channel Estimation references. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
3. The method as recited in claim 2, further comprising: transmitting said modified forward path data signal over at least one forward transmission path.	Project Angel discloses transmitting said modified forward path data signal over at least one forward transmission path. For example, see the following passages and/or figures, as well as all related disclosures: See discussion of 1[p], 1[c] describing forward path transmissions (downlink from base station) and signals sent thereon using OFDM subcarriers. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art.

'369 Patent	Project Angel
	Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the OFDM Tone Modification references. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
4. The method as recited in claim 1, wherein said reverse path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data.	Project Angel discloses wherein said reverse path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data. For example, see the following passages and/or figures, as well as all related disclosures: See discussions in 1[p], 1[a] regarding usage of QPSK on various channels. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Channel Estimation and QPSK Usage references. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
5. The method as recited in claim 1, wherein said modified forward path data signal includes at least one type of data selected from a	Project Angel discloses The method as recited in claim 1, wherein said modified forward path data signal includes at least one type of data selected from a group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data. For example, see the following passages and/or figures, as well as all related disclosures: See citations for claim 4.

'369 Patent	Project Angel
group of different types of data comprising Orthogonal Frequency Division Multiplexing (OFDM) data and Quadrature Phase Shift Keying (QPSK) data.	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the OFDM Tone Modification and QPSK Usage references.. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
6. The method as recited in claim 5, wherein said modified forward path data signal includes sub-carrier pre-equalized OFDM data.	Project Angel discloses wherein said modified forward path data signal includes sub-carrier pre-equalized OFDM data. For example, see the following passages and/or figures, as well as all related disclosures: See discussion of 1[p], 1[c] describing forward path transmissions (downlink from base station) signals with pre-equalized OFDM subcarriers data. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the OFDM Tone Modification references.. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
7. The method as recited in claim 6, further comprising:	Project Angel discloses generating corresponding Quadrature Phase Shift Keying (QPSK) modulation values based on said sub-carrier pre-equalized OFDM data. For example, see the following passages and/or figures, as well as all related disclosures:

’369 Patent	Project Angel
generating corresponding Quadrature Phase Shift Keying (QPSK) modulation values based on said sub-carrier pre-equalized OFDM data.	See citations for claims 4, 5, 6. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants’ Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the OFDM Tone Modification and QPSK Usage references. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
9. The method as recited in claim 1, wherein said reverse path data signal includes identifiable training data.	Project Angel discloses The method as recited in claim 1, wherein said reverse path data signal includes identifiable training data. For example, see the following passages and/or figures, as well as all related disclosures: See discussion of in 1[p], 1[a] on usage of pilot tones as identifiable training date for adjustments. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants’ Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Training Data references.. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
10. The method as recited	Project Angel discloses comparing said identifiable training data to a local version of said training data to identify said at least one multipath transmission delay within said reverse path data signal.

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in claim 9, further comprising: comparing said identifiable training data to a local version of said training data to identify said at least one multipath transmission delay within said reverse path data signal.	For example, see the following passages and/or figures, as well as all related disclosures: See citations for claim 9. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Training Data references. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
12. The method as recited in claim 3, wherein said at least one reverse transmission path is substantially reciprocal to said at least one forward transmission path.	Project Angel discloses wherein said at least one reverse transmission path is substantially reciprocal to said at least one forward transmission path. For example, see the following passages and/or figures, as well as all related disclosures: See discussion of 1[p], 1[a], 1[b] describing that the base station is a transmitting device (e.g., for the downlink OFDM symbols) and that it also determines the pre-equalization parameter and performs the modification of the forward path (downlink) data signal based on the reverse link. See discussion of 1[p], 1[a], 1[b], 1[c] describing that the base station is a transmitting device (e.g., for the downlink OFDM symbols) and that it also determines the pre-equalization parameter and performs the modification of the forward path (downlink) data signal based on the reverse link. The use of the reverse link channel conditions in this reference to adapt the forward path transmissions discloses this claim.

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	This reference discloses TDD and using reverse path channel response to predict forward path channel response, which a POSITA would understand to necessarily disclose the limitations of this claim element. Indeed, the '369 acknowledges that reciprocity was already well-known prior to the '369 patent, particularly for TDD channels. See '369 patent at 7:22-34 ("**<u>As is well known</u>**, many materials are electromagnetically isotropic, which is a property resulting from symmetry in their associated permittivity and permeability tensors. The Lorentz Reciprocity Theorem applies to such materials. Refraction and dielectric reflection from materials therefore often show reciprocity, or equivalence of forward and reverse channel characteristics. Diffraction and reflection are inherently reciprocal due to the minimal media affecting the electromagnetic wave. Thus, reciprocity can be used to determine channel characteristics that are used while pre-equalizing a transmitted path. The use of a reciprocal channel is very useful, for example, when Time Division Duplex (TDD) channels are implemented."). One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Channel Estimation references. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
13. The method as recited in claim 1, wherein identifying said at least one multipath	Project Angel discloses wherein identifying said at least one multipath transmission delay, determining said at least one forward path pre-equalization parameter, and modifying said forward path data signal are performed by a transmitting device. For example, see the following passages and/or figures, as well as all related disclosures:

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transmission delay, determining said at least one forward path pre-equalization parameter, and modifying said forward path data signal are performed by a transmitting device.	See discussion of 1[p], 1[a], 1[b], 1[c] describing that the base station is a transmitting device (e.g., for the downlink OFDM symbols) and that it also determines the pre-equalization parameter and performs the modification of the forward path (downlink) data signal. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Channel Estimation references. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
14. The method as recited in claim 13, wherein said transmitting device includes a base station device that is operatively configured for use in a wireless communication system.	Project Angel discloses wherein said transmitting device includes a base station device that is operatively configured for use in a wireless communication system. For example, see the following passages and/or figures, as well as all related disclosures: See citations for claim 13. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Channel Estimation references Rather than repeat those disclosures here, they are incorporated by reference into this chart.

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15. The method as recited in claim 13, further comprising: using at least one transmitting device receive antenna operatively coupled to said transmitting device to receive said reverse path data signal over at least one reverse transmission path from the receiving device.	Project Angel discloses using at least one transmitting device receive antenna operatively coupled to said transmitting device to receive said reverse path data signal over at least one reverse transmission path from the receiving device. For example, see the following passages and/or figures, as well as all related disclosures: One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants’ Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Antenna Arrays references.. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
19. The method as recited in claim 15, wherein said transmitting device is operatively coupled to a plurality of first	Project Angel discloses wherein said transmitting device is operatively coupled to a plurality of first device receive antennas. For example, see the following passages and/or figures, as well as all related disclosures: See discussion for claim 15. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the

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device receive antennas.	time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Antenna Arrays references.. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
21. The method as recited in claim 15, wherein determining said at least one forward path pre-equalization parameter based on said at least one transmission delay further includes: determining at least one angle of arrival of said reverse path data signal with respect to said at least one transmitting device receive antenna.	Project Angel discloses wherein determining said at least one forward path pre-equalization parameter based on said at least one transmission delay further includes: determining at least one angle of arrival of said reverse path data signal with respect to said at least one transmitting device receive antenna. For example, see the following passages and/or figures, as well as all related disclosures: See discussion for claim 15. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Antenna Arrays references.. Rather than repeat those disclosures here, they are incorporated by reference into this chart.

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28. The method as recited in claim 13, further comprising: using at least one transmitting device transmit antenna operatively coupled to said transmitting device to transmit said modified forward path data signal over at least one forward transmission path to the receiving device.	Project Angel discloses using at least one transmitting device transmit antenna operatively coupled to said transmitting device to transmit said modified forward path data signal over at least one forward transmission path to the receiving device. For example, see the following passages and/or figures, as well as all related disclosures: See discussion for claim 15. See discussion in 1[p], 1[c] regarding transmissions from base station to subscriber. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Antenna Arrays references.. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
32. The method as recited in claim 28, further comprising: setting at least one antenna pointing parameter associated with	Project Angel discloses setting at least one antenna pointing parameter associated with said at least one transmitting device transmit antenna based on said at least one forward path pre-equalization parameter. For example, see the following passages and/or figures, as well as all related disclosures: See discussion for claim 15. See discussion in 1[p], 1[c] regarding transmissions from base station to subscriber.

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said at least one transmitting device transmit antenna based on said at least one forward path pre-equalization parameter.	One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants’ Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Antenna Arrays references. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
33. The method as recited in claim 28, further comprising: setting at least one phased array antenna transmission directing parameter associated with said at least one transmitting device transmit antenna based on said at least one forward path pre-equalization parameter.	Project Angel discloses setting at least one phased array antenna transmission directing parameter associated with said at least one transmitting device transmit antenna based on said at least one forward path pre-equalization parameter. For example, see the following passages and/or figures, as well as all related disclosures: See discussion for claim 15. See discussion in 1[p], 1[c] regarding transmissions from base station to subscriber. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants’ Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Antenna Arrays references._. Rather than repeat those disclosures here, they are incorporated by reference into this chart.

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35. The method as recited in claim 28, further comprising: selecting said at least one transmitting device transmit antenna from a plurality of transmitting device transmit antennas that are each operatively coupled to said transmitting device.	Project Angel discloses selecting said at least one transmitting device transmit antenna from a plurality of transmitting device transmit antennas that are each operatively coupled to said transmitting device. For example, see the following passages and/or figures, as well as all related disclosures: See discussion for claim 15. See discussion in 1[p], 1[c] regarding transmissions from base station to subscriber. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Antenna Arrays references.. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
36. The method as recited in claim 35, further comprising: selectively transmitting a plurality of beams using two or more transmitting	Project Angel discloses selectively transmitting a plurality of beams using two or more transmitting device transmit antennas. For example, see the following passages and/or figures, as well as all related disclosures: See discussion for claim 15. See discussion in 1[p], 1[c] regarding transmissions from base station to subscriber. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the

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device transmit antennas.	time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Antenna Arrays references.. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
37. The method as recited in claim 36, wherein each of said transmitted plurality of beams is selectively adjusted in phase and amplitude to reduce multipath affects when received by said receiving device.	Project Angel discloses wherein each of said transmitted plurality of beams is selectively adjusted in phase and amplitude to reduce multipath affects when received by said receiving device. For example, see the following passages and/or figures, as well as all related disclosures: See discussion for claim 15. See discussion in 1[p], 1[c] regarding transmissions from base station to subscriber. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the Antenna Arrays references._. Rather than repeat those disclosures here, they are incorporated by reference into this chart.
41. The method as recited in claim 1, wherein	Project Angel discloses wherein determining said at least one forward path pre-equalization parameter based on said at least one transmission delay further includes: sub-band equalizing said forward path data signal using corresponding frequency domain reverse path data.

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determining said at least one forward path pre-equalization parameter based on said at least one transmission delay further includes: sub-band equalizing said forward path data signal using corresponding frequency domain reverse path data.	For example, see the following passages and/or figures, as well as all related disclosures: See discussion in 1[p], 1[c] regarding transmissions from base station to subscriber. One of ordinary skill would find this limitation disclosed either expressly or inherently in the teachings of this reference and its incorporated disclosures taken as a whole, or in combination with the state of the art at the time of the alleged invention. To the extent this reference is not found to teach this element explicitly, implicitly, or inherently, the element would have been obvious to one of ordinary skill in the art based on this reference, common sense, ordinary creativity of one of ordinary skill in the art, and the state of the art. Additionally, it would have been obvious to combine this reference with one or more other prior art references identified in Defendants' Invalidity Contentions Cover Pleading, particularly, the passages in the base invalidity contention document discussing the OFDM Tone Modification references.. Rather than repeat those disclosures here, they are incorporated by reference into this chart.